DOCUMENT RESUME

ED 373 315 CS 011 814

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TITLE The Effects of Three Instructional Conditions in Text Structure on Upper Elementary Students' Reading Comprehension and Writing Performance.
PUB DATE 4 Apr 94
NOTE 49p.; Paper presented at the Annual Meeting of the American Educational Research Association (75th, New Orleans, LA, April 4-8, 1994).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Instructional Effectiveness; Intermediate Grades; *Reading Achievement; *Reading Comprehension; Reading Research; *Text Structure; *Writing Achievement; Writing Research
IDENTIFIERS Expository Text; Graphic Organizers

ABSTRACT

A study tested the effectiveness of three instructional strategies in three expository text structures on students' reading comprehension and writing performance. Subjects, 173 fourth, fifth, and sixth graders, were randomly assigned to one of three conditions: mental modeling, graphic organizer, or a control read/answer group. They received instruction in the characteristics of three text structures: attribution, collection, and comparison. Reading comprehension and writing performance were measured six times during the 6-week period. Results indicated: (1) significant effects for treatment, time of measurement and reading ability, and significant interaction effects for time by grade; (2) the most effective strategy was use of graphic organizers; (3) attribution and comparison tests were significantly higher than collection tests; and (4) fifth graders achieved the highest scores on most reading comprehension measures. Results of writing performance measures indicated main effects for time of measurement and treatment; students wrote significantly better after attribution and comparison formats than after the collection pattern; mental modeling outperformed the control group on the attribution and the immediate writing samples, while both mental modeling and graphic organizer conditions outperformed the control group on the delayed writing sample. Results also indicated that attribution and comparison formats were the most salient with upper elementary students after instruction, while student interview responses demonstrated positive attitudes and higher content knowledge among students in the experimental groups. (Contains 59 references; includes 10 tables and 2 figures of data. A mental modeling attribution example, a comparison example, and an example of the read and answer group's task are attached.) (RS)

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ED 373 315

# The Effects of Three Instructional Conditions in Text Structure on Upper Elementary Students' Reading Comprehension and Writing Performance

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**Paper Presented at AERA, New Orleans,**

**April 4, 1994**

CS 011514

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## ABSTRACT

The purpose of this study was to test the effectiveness of three instructional strategies in three expository text structures on students' reading comprehension and writing performance.

One hundred seventy three fourth, fifth, and sixth graders participated in the six-week study and were randomly assigned to one of three treatment conditions: mental modeling, graphic organizer, or a control read/answer group. They received instruction in the characteristics of three text structures: attribution, collection, and comparison. Reading comprehension and writing performance were measured six times during the study.

The reading comprehension results of the nonorthogonal repeated measures analyses of variance indicated significant effects for treatment, time of measurement (tests after text structure instruction) and reading ability, and significant interaction effects for time by grade. The most effective strategy was use of graphic organizers. High ability readers outperformed low readers on all measures. Attribution and comparison tests were significantly higher than collection tests. Fifth graders achieved the highest scores on most reading comprehension measures.

Writing performance results of a nonorthogonal repeated measures analyses of covariance indicated main effects for time of measurement (writing samples after instruction) and treatment. Students wrote significantly better after attribution and comparison formats than after the collection pattern. Mental modeling outperformed the control group on the attribution and the immediate writing samples, while both mental modeling and graphic organizer conditions outperformed the control group on the delayed writing sample.

Attribution and comparison formats were the most salient with upper elementary students after instruction, while student interview responses demonstrated positive attitudes and higher content knowledge among the students in the experimental groups.

Implications for further research include continued exploration of expository text structure strategies with elementary students and their incidental effect on student writing performance.

## Review of Related Literature

Many elementary students struggle in subjects such as science and social studies not because they are unable to decode the texts, but because they are deficient in the cognitive activities that foster internalization of concepts. In other words, many students may know the fundamentals of reading, but are not able to apply their reading skills to gain information from texts. Indeed, they have learned to read, but cannot quite read to learn (Singer & Donlan, 1989). One of the problems native to content instruction is the large quantity of information and conceptual density of the text (Readance, Bean & Baldwin, 1981). Textbooks by their very nature tend to introduce large numbers of unfamiliar concepts, new technical terms, and support details in a highly compressed format (Readance et. al). Indeed, there is a substantial research base suggesting that prior knowledge and the organizational structure of a text are critical factors that influence children's content-area comprehension (Anderson & Pearson, 1984).

Mayer (1989) describes a simple but useful conceptualization of the cognitive processes involved in meaningful learning from text. According to Mayer, meaningful learning depends on three basic processes: *selecting, organizing,* and *integrating.* Selecting involves paying attention to the information in the text and particularly focusing attention on information that is relevant to the goals or task demands of the learning situation. Organizing involves arranging the units of selected information into a coherent mental structure. This is the step that builds internal connections between ideas in the text. Integrating refers to the process by which links are made from the coherently organized information to existing cognitive structures. According to Armbruster, Anderson, & Meyer (1991), expert, or skilled readers, are adept at all three basic cognitive processes, but novice (younger or poorer) readers are not. Children in the middle grades (4 through 9) often appear to have difficulty with these three processes when attempting to learn from informational text.

One way of *selecting* and *organizing* information from text is simply to use the author's organization or "top-level" structure. There are many current hypotheses of reading comprehension that assume skilled readers automatically abstract a "top-level" or higher order structure (Meyer, 1975; van Dijk & Kintsch, 1983). This higher order structure or *macrostructure* (van Dijk & Kintsch, 1983) represents the gist of a text arranged into a coherent whole.

Kintsch and van Dijk (1978) have designed a model of comprehension and production that suggests why structure is vital to the comprehension and production processes. Berkowitz (1986) explains the model this way:

> ...readers possess schemata that represent their knowledge of conventionalized texts such as stories, arguments, and psychological reports. When available, these schemata drive macrorules, which act on the micropropositions of the material read to formulate a macrostructure, or gist, for this material. Because it is impossible for a reader to recall everything from a passage, a macrostructure is formed representing the information a reader perceives as important. It is the macrostructure, not the original text, that the reader remembers. Later, when attempting to recall the material, the reader uses the macrostructure to reproduce the text. (p. 162)

Armbruster, Anderson, and Ostertag (1987) agree that macrostructure guides encoding, recall, and reproduction of the essential points of the text and that formation of macrostructures is a prerequisite for success in tasks involving global comprehension and meaningful learning.

Thus, it seems critical that teachers help students to develop the ability to form macrostructures to increase reading comprehension. One way to accomplish this is through instruction in text structure. The research on this topic is usually categorized into *awareness* and *instructional* studies.

The collective results of the awareness studies (Troyer, 1992; McGee, 1982; Meyer, Brandt & Bluth, 1980; Elliot, 1980; Taylor, 1980) indicate that age and reading ability are highly correlated with recall of expository material, perhaps because skilled readers have acquired a greater awareness of the author's text structure patterns. In other words, high ability readers and older students are more likely to extract (i.e., select and organize) the main idea of passages through awareness of text structure than low ability readers and younger students.

Armbruster, Anderson and Ostertag (1987) conclude that training in the use of text structure improves reading comprehension. Quite simply, when students are taught procedures and strategies they can use in identifying text structure, and when, in fact, they actually use these target procedures, they recall more information from texts than those students who do not use the strategies.

There are several ways in which researchers conduct instructional text structure studies. One approach to teaching text organization is to provide treatment in one or more specific text structures commonly used in expository texts such as attribution, collection, comparison, problem/solution, and cause-effect (Englert & Hiebert, 1984; Meyer, 1975). Brooks & Dansereau (1983) trained subjects in a strategy

called *structural schema* while Miller and George (1992) used an Expository Passage Organizer to teach different types of text structures.

Another strategy is to provide instruction in typographical cues. For example, Taylor (1982) and Taylor and Beach (1984) used a hierachical summarization task in their research. This consisted of first preparing a skeletal outline based on headings, subheadings, paragraphs, and then writing a main idea statement for every point in the outline. One limitation to this type of instruction is its application only to the heading-subheading format and its dependence on the ability of the headings and subheadings to convey the structure of the text.

A third strategy is the use of concrete representation in the form of instructional graphics (Holley & Dansereau, 1984) to teach verbal information in a spatial array. According to Armbruster, Anderson, and Meyer (1991):

> Instructional graphics include what have been called structured overviews, graphic organizers, maps, knowledge maps, networks, schematizations, and flow charts. In all of these techniques, words or phrases are connected with named or unnamed links that convey the structure or organization of ideas. (p. 396)

Singer and Donlan (1989) state that the purpose of graphic organizers is to show relationships among concepts. Using branched diagrams, the coordinate, subordinate, and the superordinate relationships among the topics are illustrated. These teacher-made visuals provide students with useful overviews prior to reading.

Another promising technique for teaching text structure is that of mental modeling. That is, the instructor "thinks aloud" in front of the class demonstrating how he/she extracts pertinent information. Teachers have always performed physical demonstrations of specific tasks, however recent emphasis on the strategic and metacognitive aspects of reading (Paris, Lipson, and Wixson, 1983) demonstrates the need for modeling not only the physically observable aspects of reading but also the invisible mental processes at the heart of the reading process. Flood and Lapp (1992) found that the behaviors of the competent comprehender, the strategic reader, are indeed learned behaviors. They posit that texts cannot teach students how to read--only teachers can. Teachers need to show children how, when, and why to comprehend because children do not spontaneously learn how to read. They need to be shown what to do through strategies and techniques like "Think Alouds" and "Mental Modeling". In other words, teachers

need to show students the ways in which they (the teachers) process texts. Duffy and Roehler (1988) explain that teachers must make their reasoning "visible" so that students can become conscious of the process that is involved in constructing meaning. They contend that once students begin to "see" their teachers mental processes, they can then begin to employ similar strategies to make meaning for themselves.

The question remains, however, as to whether one particular text organization is more advantageous to student recall and comprehension than another, and whether one particular instructional strategy, such as mental modeling or graphic organizers, when used to teach text structure, will result in enhanced student reading comprehension. In other words, given upper elementary students studying oceanography content, will the students understand the content in one text structure format more easily than the other two, and will a particular instructional condition enhance comprehension across all text structures?

Research on text structure awareness and instruction has elicited the following summary of results: 1) top-level ideas are retained and recalled better than are lower-level ideas; 2) the types of relationships among ideas greatly influence recall when they occur at the top level of the content structure, but the same is not true at the bottom level; 3) different types of relationships at top-level structures affect recall differentially; 4) students who can identify and use top-level structure remember more of what they read than students who do not or cannot; 5) students can be taught to identify top-level structure (the author's pattern); 6) training in use of top-level structure increases reading comprehension as measured by free recall; 7) failure to use top-level structure has a more negative impact when the topic of the passage is unfamiliar than when it is familiar (Meyer, 1984).

In addition, studies using specific strategies such as graphic organizers and mental modeling as pre-reading strategies have generally yielded positive results at all levels. The following experiment will attempt to determine if one of these techniques is significantly better than the other when teaching upper elementary students characteristics of three text structures to increase their comprehension of content information.

Recent descriptions of the relationship between reading and writing suggest that instruction about text structure can also improve writing (Shanahan, 1988). Indeed, many experiments have, in fact,

achieved positive writing results through instruction in text structure (e.g., McGee & Richgels, 1985; Miller & George, 1992; Taylor, 1982; Taylor & Beach, 1984; Armbruster, Anderson & Ostertag, 1987; Pearson, 1985). It is possible then, with this particular topic (i.e., text structure), thinking, comprehending, and composing processes are so interrelated that proficiency in any one transfers to the others as well. Flood, Lapp, & Farnan (1986) agreed that students glean information about a text's organization not only from reading, but also by attempting to write text itself. As students attempt to control structure through writing, they gain insight into how writers organize their information to maximize the reader's comprehension. Conversely, when students fail to organize information effectively in their own writing, they are better able to understand and empathize with the difficulties this causes for their audience.

Hennings (1982) noted that students infrequently compose on relational topics from science and social studies. As a result, students have few opportunities to develop their ability to organize expository content on paper. Yet this learning is basic, for it relates to reading as well as to writing. In learning to organize informational content for writing, students gain insight into how authors handle complex ideas on paper and thus, refine their schemata for understanding this type of content (Hennings).

Most educators and researchers acknowledge a strong relationship between reading and writing. Specifically, one of the oldest ways to teach children to write is by presenting them with model pieces of writing. Scardamalia and Bereiter (1986) classify model pieces of writing as a form of product-oriented instruction. It is assumed that students will be able to transfer what s/he observes in the model to his/her own writing. An additional component of this study was to determine if a specific instructional strategy in and exposure to different text structures incidentallycarried over to student writing performance.

## Development of the Hypotheses

It is clear from the literature that students as young as third grade benefit from specific instruction in text structure. Recognizing and utilizing the author's top-level structure provides positive results in both reading comprehension and writing. There are a variety of strategies being tested at various grade levels to determine how best to proceed with this type of instruction. The specific focus of this study is to determine if the use of graphic organizers or mental modeling proves better for improving student reading comprehension with incidental effects on writing performance than the more traditional " read and answer

questions" format so often used in classrooms today. These two strategies were selected because of their visual and auditory components, and because both are relatively easy to prepare and to implement in classrooms. The mental modeling strategy requires virtually no extra preparation for the teacher, while the graphic organizer takes just a short time to prepare.

Another goal of this study was to determine which of three text structures--attribution, collection, or comparison--is more "user friendly" for children of grades 4, 5, and 6 randomly stratified by reading abilities into three groups.

A third objective was to assess what students thought about the three instructional conditions and the three text structures that were taught. Researcher inference about results typically reflects an adult point of view and the following study will consider student input when making judgments and drawing conclusions about the results of the study.

Thus, the purpose of this study was threefold: 1) to determine whether a specific instructional condition in three text structure formats enhanced upper elementary students' comprehension of expository text; 2) to ascertain whether these same instructional conditions and text structure formats significantly improved student writing performance; and, 3) to obtain information from students regarding their perceptions about the various instructional conditions and text structures.

## Design of the Study

### Description of Subjects

This study was conducted with 173 fourth, fifth, and sixth grade students, 97 boys and 76 girls, in one K-6 public elementary school in a middle class neighborhood of older homes and apartments in south Orange County, California, during the months of January and February, 1993. Although the district is considered to be one that services a relatively affluent population, the families at this particular site range from lower to middle class. In addition, the standardized test scores of most grade levels fall below the district average. Schoolwide, the student body is 67% Anglo, 22% Hispanic, 10% Asian, and 1% Black.

Although there were 203 subjects at the beginning of the study, 30 were eliminated for the following reasons: excessive absences (four or more consecutive days) for both illness and extended family trips, moving from the school, and teacher judgment that the reading material was too difficult for a few very low ability students. (These included RSP students and LEP students fluent in oral English, but

whose skills in reading English were still remedial.)

By the end of the study there remained 48 fourth grade students from two classrooms (mean age = 9 years, 6 months), 75 fifth grade students from three classrooms (mean age = 10 years, 5 months), and 50 sixth grade students from two classrooms (mean age = 11 years, 8 months) for a total of 173 subjects. All were fluent in English.

Group Assignments

From class lists provided by the participating teachers, students were stratified by grade and by reading ability and then randomly assigned to one of three instructional conditions that received instruction in identical content, randomly counterbalanced to avoid an order effect, in each of three text structure formats over the duration of the study. The reading score was taken from the Comprehensive Test of Basic Skills (CTBS, 1988) administered the previous spring. Students new to the school who had not previously taken the measure took the test before the research began. Those who scored at or above the 75th percentile were considered high readers; those who scored between the 50th and 74th percentiles were considered to be high average readers; pupils whose reading scores fell between the 25th and 49th percentiles were named low average readers, while anyone scoring below the 25th percentile was classified a low abilityreader.

Test of Prior Knowledge and Initial Writing Sample

Before the study began, a "test of prior knowledge" was administered by each teacher. The directions for this pretest were given by this researcher at an assembly immediately prior to the distribution of the measure. The test consisted of 20 multiple choice items patterned after Yochum (1991) in which there is one correct answer, two distractors, and an *I don't know* choice to minimize guessing. An analysis of variance [$F(2,170) = 0.14$, $p>0.8695$] indicated no significant differences among the three groups' levels of prior knowledge.

In addition, in order to obtain a baseline writing sample, students were asked to respond in writing to a specific expository prompt called the "Initial Writing Sample." Students were given a choice of the following topics: *Think about an animal you are familiar with and fully describe it. Be sure to include in your essay its appearance, habitat, usefulness, or any other unique qualities your animal possesses,*

or

*Think about the last time you went to the beach. You probably saw many interesting things such as shells, people, equipment, animals, boats, food, etc. Choose any two things you saw and describe in essay form how they are alike and how they are different.*

Essays were holistically scored using a six point rubric that detailed criteria for organization, clarity, content, sentence structure, and coherence. These scoring guidelines were modeled after Knudson (1988).

## Materials

Science activity books called *Scientific Encounters of the Mysterious Sea* (Embry, 1987) and *North American Sea Life* (Whyte,1973) were used as the instructional instruments for this study because of the high interest level of their individual selections about unusual creatures who live in the ocean and because the individual essays were written for Grades 4-7, according to the publisher. The daily selections during the attribution and collection conditions were about 300-350 words. The comparison essays were about 650-725 words because students were reading information about two animals per day instead of one.

## Method

### Procedure

In order to procure subjects for this research effort, upper grade teachers were asked to volunteer their classes. The response was positive and all nine upper grade teachers in this school wished to be included. Seven classes were selected; two classes were not chosen because they were composed of all GATE students and would have rendered the results less generalizable. Before commencement of the study, I met after school with the participating fourth, fifth, and sixth grade teachers to explain the purpose of the study and to answer any questions. One of their concerns was whether to include all English-speaking students in the research. After examining a few of the materials, some thought that perhaps the reading would be too difficult for some very low ability students who are tutored daily in reading skills in RSP. I left the decision to each individual teacher since they knew whether a particular student's inclusion would cause undue stress and frustration to that child. In the end, most of the English-speaking students began the study, but a few were eliminated later when it became apparent to their teachers that they were unable to read the essays without some frustration. The Fry Readability Formula (Fry, 1968), applied to several content samples, indicated the reading level to be approximately low fifth to middle sixth grade

Thus, it seemed that the materials might be too difficult for all low ability students and, in particular, the fourth grade participants. However, teachers decided that the materials did, in fact, closely match the difficulty levels of the students' content texts (i. e., science and social studies) and therefore, the results would increase the generalizability of this research. They also agreed that the findings of this study would provide enlightenment about effective content instructional strategies.

Teachers were told that if a student was absent for a short period of time, he/she could "make up" the readings upon his/her return. If, however, a student was absent for more than four consecutive days, they were to inform me so that student could be eliminated from the project.

The study was conducted over a six-week period of time. In order to control for "teacher effect," I taught all initial instructional strategies at the beginning of each week of treatment. For example, at the beginning of Week 1, I taught Group 1 the characteristics of the attribution text structure followed by instruction in a mental modeling strategy, designed to help students glean content information from the attribution structure. I taught Group 2 the same characteristics of the attribution format but followed with instruction in the use of a graphic organizer to aid in their understanding of the content within the structure. When I met with Group 3, I gave them the same instruction in the attribution text structure the other two groups had received, but the follow-up strategy was more traditional than mental modeling or graphic organizers. Instead, they were told to study five questions about the content they would read in order to focus their attention. I followed the same procedure during the subsequent weeks, changing only the information about characteristics of the particular text structure format .

Instructional Conditions

After stratified random assignment based on grade level and reading ability to one of three conditions, and after the completion of the prior knowledge test and baseline writing sample, students received instruction in and exposure to identical content (randomly counterbalanced) and text structure according to the instructional condition to which they were assigned.

Mental modeling. Group 1 was an experimental group that received instruction in characteristics of three text structures and were taught how to decipher information within the structure through mental modeling-- a "think aloud" technique demonstrated by the teacher in which his/her reasoning is made "visible" to the students so they understand their teachers' mental processes, and thus begin to model them

(Flood & Lapp, 1992; Duffy & Roehler, 1987). (See Appendix for an example used in this study.)

Graphic organizer. Group 2 was also an experimental group that received instruction in characteristics of the same three text structures as well as instruction in the use of graphic organizers to enhance their comprehension of the content. A graphic organizer is a teacher-made visual usually in the form of a branched diagram that shows relationships among topics or concepts (Singer & Donlan, 1989). Three different visuals were created for this study to match the text structures. (See Appendix for an example used in this study.)

Read and answer. Group 3 was considered to be the control group. Although pupils assigned to this group received the same instruction in and exposure to the various text structure components as the other groups, their instructional strategy for enhancing and remembering the content was less innovative and more traditional than the others. Students in Group 3 were given five questions to study before silently reading their essays. Although this strategy served the same purpose as both mental modeling and use of graphic organizers--to focus students' thinking on the content and to serve as an advance organizer to increase student comprehension of the content--it more closely modeled a typical expository assignment in today's classrooms where students are often asked to read several pages and later answer questions. The only difference was that pupils in this study were provided with questions ahead of time. In addition, Group 3 was considered the control group because their "questions" strategy did not reinforce the characteristics of the text structures on a daily basis as did the mental modeling and graphic organizer strategies.(See Appendix for examples used in this study.)

Text Structure Conditions

Students in all three groups received instruction in the characteristics of three different text organizational patterns to increase their ability to recognize these structures and, thus, more efficiently process content information. Although there are other text structures common to children, such as problem-solution and cause-effect, the following organizational patterns were selected for this study because they more closely matched the descriptive nature of the oceanography content.

Attribution. This structure is described as one which focuses on individual characteristics of a target topic, in this case, undersea mysterious animals (Yochum, 1991). Headings were used to highlight the major categories of information to which students were exposed and the revision was modeled after

examples given by Yochum. Students read essays on the *Argonaut, Fying Fish, Giganturid, Lantern Fish, Narwhal, and Ocean Sunfish* .

Collection. This format includes more than one grouping by association and may include an ordering of elements such as enumeration and sequencing by time (Richgels, McGee, Lomax, & Sheard, 1987). There were no headings in this pattern, but students were instructed to notice words like *first, second, third, next, finally, lastly* to signal the main topics. With the absence of headings and with the inclusions of enumerations, the collection structure often reads like narrative text. The essays rewritten in the collection format were on the following mysteries of the sea: *Northern Basket Starfish, Sea Cucumber. Portugese Man-Of-War, Trunkfish, Viperfish,* and the *Angel Shark.*

Comparison. During this condition, students were exposed to two animals a day instead of one because this format focused on similarities and differences between two target animals. Again, headings were used to focus students' attention on main categories of information. This structure also was modeled after examples given by Yochum (1991). Students' daily readings provided information on the *Barberfish* and *Electric Ray, Croaker* and *Comb Jelly, Stonefish* and *Sea Snake, Sargassum Fish* and *Queen Angelfish.*

Research Schedule

Each day's assignment took 20-30 minutes and each instructional treatment lasted five to seven days. The duration of the comparison structure was less because students read information about two animals a day instead of one, but were, in fact, exposed to eight animals (instead of six) over the course of the condition. On the direct instruction days, students were called from their classrooms to the library at appointed times. There were approximately 60 students per instructional condition receiving direct instruction at the same time.

Direct instruction. The first day of each treatment consisted of specific instruction (in the library setting) on the characteristics of the target text structure and in the maximization of the strategies– mental modeling, graphic organizers, or questions. Also, unfamiliar vocabulary words were discussed. Students were reminded about using context clues, careful rereading, studying the picture, and other strategies for assisting in their vocabulary development. They were reminded that when they completed the readings in their classrooms without my instructional assistance, dictionaries were available ( as they always are during

regular lessons) to aid in their understanding of a word that might be causing interference with their comprehension of the content information. They were directed not to ask their teachers word meanings. Additionally, students were reminded to put names on readings, to study cover pages carefully (i.e., the individual strategies), to read the content at least twice, and then, to write five to ten facts or to answer the questions (Read/Answer Group).

Daily tasks and responsibilities. The subsequent days of each treatment were devoted to additional presentation of the instructional condition and the text structure through silent reading of oceanography essays. In addition to the undersea mystery content page, each participant also received a "cover page" stapled to the essay containing one of the following: a) a mental modeling of the main ideas of the essay; b) a graphic organizer, depicting a visual "branching" of the main points of the content; or, c) questions specific to the content of the reading for students to peruse ahead of time, to be answered after their silent reading. Students completed these readings in their classrooms under the supervision of their teachers, who also reiterated permission to use dictionaries for unfamiliar vocabulary whose meaning could not be inferred. Teachers were asked to give only procedural assistance to the students in order to ensure environmental uniformity and equity among the seven classes. To guarantee that each child would receive the appropriate instructional material, the readings were color-coded by group (Group 1 readings and cover pages were yellow, Group 2 readings and cover pages were pink, and Group 3 readings and cover pages were green). Each student knew the color of his/her group and each teacher had a class list indicating the group assignment of each child in the class. The readings and cover pages were collated, and delivered to each classroom a day ahead of time. Daily teacher responsibilities were to pass out the essays, read aloud the directions to the class, monitor while students read, and collect readings after 20 minutes. Students in Groups 1 and 2 were told to study the cover page carefully (Mental Modeling or Graphic Organizer) and then to read the essay silently at least twice. They were encouraged to underline, highlight, take notes, or perform any task to aid in their retention of the content. Students were told that upon completing the reading for the day, they should turn their papers over and attempt to write five to ten facts they could recall without looking back (Troyer, 1992). Group 3 received identical directions, except instead of writing five to ten facts after reading, they were told to answer the questions on their cover page.

Each passage was rewritten by this researcher to conform to either an attribution, comparison, or collection format and was modeled after Yochum (1991). Selections were single spaced and each contained a simple sketch of the target animal.

Evaluation measures. After each treatment, the students in all three groups completed both a fill-in-the-blank/short answer posttest worth 20 points and a writing sample based on the content and text structure they had just learned. For instance, after exposure to several undersea animals via the comparison structure, students were asked to describe the similarities and differences of any two animals of their choice, such as the sea snake and the croaker.

Times of measurement. There were six times of measurement during the study:

1. Prior Knowledge Test and Initial Writing Sample (before treatment began)
2. Posttest 1 and Writing Sample 1 (after attribution treatment)
3. Posttest 2 and Writing Sample 2 (after collection treatment)
4. Posttest 3 and Writing Sample 3 (after comparison treatment)
5. Final Posttest and Final Writing Sample (a few days after all treatment was completed)
6. Delayed Posttest and Delayed Writing Sample (ten days after the Final Posttests)

Thus, with the test of prior knowledge and baseline writing sample and the delayed posttest and delayed writing sample, students' comprehension and composing were measured six times over the duration of the study. All tests and writing samples were completed in the individual classrooms under the supervision of the classroom teacher, who was instructed to maintain normal testing conditions (i.e., no talking, no sharing of answers, no looking at a neighbor's paper, etc.) The tests were identical for all three groups, but also were color coded to assist me with the recording of the scores. Students were allowed up to 30 minutes to complete the test.

The prompts were written on a chalkboard or overhead projector by the teachers for the students to read and select. In addition, teachers read the prompts aloud to the class. Thus, although every student did not have his/her own copy of the prompts, all students heard the prompts read aloud by their instructors and then silently read them from the board or overhead. Students were told by their teachers to respond to the prompt on which they had the most information and to write as much as they could about that particular topic. Essays were written on white lined paper provided to the students by their teachers. Students were

allotted up to 30 minutes to complete their written responses. Teachers supervised this activity and collected all papers after time had elapsed. Both the tests and essays were completed on the same day during back-to-back blocks of time. Students completed the test first and then wrote their responses to the prompt. Teachers received directions to structure the evaluations in this manner to assist students in their recall of content for the essay. I reasoned that by taking the test first, information relevant to their chosen prompt would be recalled more easily by the pupils. It is important to remember that there was no specific writing instruction provided to students in this study.

Scoring of Tests

Comprehension tests were scored by me. Each test was worth 20 points. The test of prior knowledge consisted of twenty multiple choice items. The tests after each treatment consisted of ten fill-in-the-blank questions worth one point each and two short answer questions worth five points each. The immediate and delayed posttests were identical and consisted of five multiple choice questions worth one point each, five fill-in-the-blank questions also worth one point each, and five short answer questions worth two points each.

Scoring of Student Writing

The most common method of direct assessment for student writing is holistic scoring, an impressionistic rating of essays for overall quality based on a grade-level appropriate rubric. In the normal classroom setting, the teacher usually serves as the reader, rating each essay on a one to four or one to six point scale. In research studies, to ensure interrater reliability and to gain a more objective evaluation of student writing, there are usually two readers rating each student essay, using the same type of rubric described above. Although holistic evaluations are essentially norm-referenced, and furnish very little information about why a paper is assigned a certain score, Bertrand and Fairchild (1984) report that holistic scores, on a four point scale, approximate the normal curve and also have a significant positive correlation with measures of reading and language on a standardized test. They conclude that holistic scoring is a valid method for judging the writing of elementary students.

Students in this study received a holistic score for organization, clarity of expression, coherence, and content in their writings, but were not scored on spelling or mechanics.

Raters. The writing samples in this study were evaluated, using a six point rubric, by two credentialed elementary educators, a fourth grade teacher and a fifth grade teacher, trained to evaluate the compositions. They were paid for both the training and the scoring time.

Preparing the essays for evaluation. Before submitting the student compositions to the raters for evaluation, identifying marks were either removed or blacked out on the essays. These marks included the student's name, teacher, birthdate, and gender. Myers (1980) recommends this procedure to ensure subject anonymity. Essays were coded with an identifying number that allowed researcher identification of the student. The coding process was not revealed to the raters.

The environment. The raters met on three consecutive Saturdays and on one Sunday in late February and early March in the school library for training and scoring. The library was selected because of its large tables and conducive atmosphere. In addition, there was ample space to keep scored and unscored essays, supplies, rubrics, examples, and oceanography essays organized, accessible, and convenient. Raters took short breaks in both the morning and afternoon, as well as a half hour lunch break, but otherwise read and scored the essays approximately eight hours each day.

Training. The raters spent approximately one and one-half hours learning how to rate the compositions. At the first session, raters received instruction in the use of the rubrics. They also examined the six different prompts and the various choices within each prompt to which students responded. In addition, they read the oceanography essays for content, and participated in simulated evaluations of five essays using xeroxed copies of student essays.

Evaluation of essays. The essays were sorted into six groups: initial writing sample, attribution essays, collection essays, comparison essays, immediate post essays, and delayed post essays. Each group of compositions was read one at a time by each rater before proceeding to the next category, starting with the initial writing sample and continuing in sequential order to the delayed post essays. This procedure was necessary for the raters to keep track of the content and for bases of comparison. The first score was placed on the center of the back of the composition. The second reader's score was placed on the front of the paper wherever there was an appropriate space. Each rater alternated serving as the "head" rater, whose task it was to total the individual scores and record a compiled score on the front of each page. The raters decided to settle any discrepancies of more than one point through open discussion and consensus. The

interrater reliability coefficients (as determined by Pearson product moment correlations) were as follows: Initial Writing Sample=0.872; Attribution Writing Sample=0.888; Collection Writing Sample=0.884; Comparison Writing Sample=0.901; Immediate Writing Sample=0.913; Delayed Writing Sample=0.921.

Additional evaluation for text structure modeling. In addition to the rater evaluations, after the completion of the holistic scoring, the essays were examined again by another teacher (compensated for her time) and by the researcher to determine how well students modeled text structures in their writing. The teacher was hired to evaluate in order to increase reliability and objectivity and to decrease the researcher inference of this additional scoring process. Students received a "2" if there was an obvious attempt to model the structure to which they were exposed the week before the composition. They received a "1" if there was a weak but unsuccessful attempt to imitate the text structure, and a "0" if there was no effort to model the target organizational pattern. There was 100% agreement between the teacher and the researcher on the structure scores of the students'writing.

Student Interviews

At the end of the study, after all quantitative measures had been administered, 21 students ( one from each group from each participating classroom), were randomly selected and interviewed using the format of a scheduled standardized interview (Goetz & LeCompte, 1984). This interaction essentially is an orally administered questionnaire. The purpose of this qualitative component was to determine students' opinions about the various instructional conditions and text structures to which they were exposed. Think-aloud protocols (Duffy, et al., 1989)) are very powerful "windows" into students' minds, but some consider them to be unnatural and contrived because not many students or adults are aware enough of every thought process to accurately articulate it as they read and write. However, the findings from the studies of expert writers using think-aloud protocols have had a great effect on composition instruction in the schools (Hayes & Flower, 1986). Although these interviews were not "think alouds" per se, it seemed that they would provide as much information as a think-aloud procedure since students were asked to reflect upon their text structure instructional experience shortly after their active participation in the study.

Student interview questions. I met with the randomly selected students individually in the school library during late February and early March, approximately one week after the delayed posttest. I told each that I wanted to solicit their opinions about the research study in which they had participated. I then

explained that I would ask 21 questions and would record their oral responses both on paper and on audiotape. I emphasized that I wanted their honest responses and that they would not hurt my feelings if they had something negative to say. I told them that their responses would help me to more accurately interpret the quantitative data and to understand more about the role of text structure and instructional strategies in content area instruction. In other words, I explained how much I needed their help and how important their responses were to the global category of reading research.

The selected students demonstrated little or no reluctance to be interviewed. The questioning was conducted during times when no classes were visiting the library so distractions were minimal. Each interview lasted approximately 20 minutes, after which students returned to their classrooms.

Evaluation of student responses.

The information provided by the students on the orally administered questionnaire was tabulated, evaluated, and categorized by this researcher. In addition, in order to decrease researcher inference and to increase reliability and objectivity of the evaluation process, a second reader was asked to perform the same evaluative tasks. The reader was a credentialed elementary teacher who was compensated for her time. Information and categories from both evaluations were consolidated. Any differences in the findings were settled through discussions. There was a high rate of agreement between the reader and the researcher.

## Results

### Reading Comprehension

The data were analyzed with a nonorthogonal repeated measures univariate analysis of variance (ANOVA) using SAS, (1990). This was a 3 (treatment) X 3 (text structures) X 5 (times of measurement) design for the first dependent variable--reading comprehension. The independent grouping variables were treatment, reading ability, and grade level.

The three levels of treatment included in the analysis were as follows: Treatment 1, mental modeling; Treatment 2, graphic organizer; and Treatment 3, read/answer. The three levels of text structure were as follows: (a) attribution structure; (b) collection structure; and (c) comparison structure. Levels of reading ability as measured by the Comprehensive Test of Basic Skills (1988) had four strata: 1 (high ability readers) = total reading score 75% and above; 2 (high average readers) = total reading score between 50% and 74%; 3 (low average readers) = total reading score between 25% and 49%; 4 (low ability

readers) = total reading score below 25%. The three grade level designations were fourth, fifth, and sixth.

The five levels of the within-subject factor, time of measurement, for reading comprehension were designed to test the following: Time 1, designed to test effect of attribution text structure; Time 2, designed to test effect of collection text structure; Time 3, designed to test effect of comparison text structure; Time 4, designed to test effect of strategy instruction immediately after the experiment; and Time 5, designed to test effect of strategy instruction approximately ten days after the experiment ended. In addition, there was a test of prior knowledge administered to determine the groups were equivalent in terms of prior knowledge. There was, in fact, no significant difference in the level of prior knowledge among the three treatment groups prior to the commencement of the study [$F(2,170) = 0.14$, $p>0.8695$]. See Figure 1 for a visual presentation of this design.

Figure 1. Text structure x instructional strategy schedule

| | Condition 1 | Condition 2 | Condition 3 |
|---|---|---|---|
| | *Attribution* | *Collection* | *Comparison* |
| Group 1 | Mental Model | Mental Model | Mental Model |
| | Content A | Content B | Content C |
| Group 2 | G. O. | G. O. | G. O. |
| | Content A | Content B | Content C |
| Group 3 | Read/Ans. | Read/Ans. | Read/Ans. |
| | Content A | Content B | Content C |
| | Reading Test | Reading Test | Reading Test |
| | Writing Sample | Writing Sample | Writing Sample |

Note. G. O. = Graphic Organizer

After receiving instruction in all three text structures by instructional strategy and after taking tests and completing writing samples after each text structure, students completed immediate and delayed

posttests and writing samples in order to assess differences in strategies (i.e., mental modeling, graphic organizer, or read/answer), which remained constant over the three text structures.

Tables 4.1 to 4.4 provide the means and standard deviations for all times of measurement, overall, by treatment, by grade level, and by reading ability.

Table 4.1

Overall Mean Scores and Standard Deviations for All Reading Tests

| Test | N | Mean | Standard Deviation |
|---|---|---|---|
| Attribution Test | 173 | 11.52 | 4.32 |
| Collection Test | 173 | 8.93 | 4.56 |
| Comparison Test | 173 | 12.12 | 4.53 |
| Immediate Posttest | 173 | 11.54 | 3.26 |
| Delayed Posttest | 173 | 12.17 | 3.93 |

Table 4.2

Treatment Mean Scores and Standard Deviations for All Reading Tests

| Test | N | Mean | Standard Deviation |
|---|---|---|---|
| **Treatment 1 (Mental Modeling)** | | | |
| Attribution Test | 60 | 12.31 | 3.71 |
| Collection Test | 60 | 8.88 | 4.35 |
| Comparison Test | 60 | 12.26 | 4.14 |
| Immediate Posttest | 60 | 11.85 | 2.72 |
| Delayed Posttest | 60 | 12.91 | 3.95 |
| **Treatment 2 (Graphic Organizer)** | | | |
| Attribution Test | 53 | 12.24 | 4.72 |
| Collection Test | 53 | 10.09 | 5.10 |
| Comparison Test | 53 | 13.09 | 4.91 |
| Immediate Posttest | 53 | 12.09 | 3.00 |
| Delayed Posttest | 53 | 12.35 | 3.94 |
| **Treatment 3 (Read/Answer)** | | | |
| Attribution Test | 60 | 10.08 | 4.23 |
| Collection Test | 60 | 7.96 | 4.08 |
| Comparison Test | 60 | 11.13 | 4.43 |
| Immediate Posttest | 60 | 10.76 | 3.84 |
| Delayed Posttest | 60 | 11.26 | 3.79 |

Table 4.3

Grade Level Mean Scores and Standard Deviations for All Reading Tests

| Test | N | Mean | Standard Deviation |
|---|---|---|---|
| **Grade 4** | | | |
| Attribution Test | 48 | 11.91 | 4.59 |
| Collection Test | 48 | 8.22 | 5.26 |
| Comparison Test | 48 | 10.50 | 4.56 |
| Immediate Posttest | 48 | 11.72 | 3.00 |
| Delayed Posttest | 48 | 10.83 | 4.16 |
| **Grade 5** | | | |
| Attribution Test | 75 | 12.04 | 4.25 |
| Collection Test | 75 | 10.04 | 4.44 |
| Comparison Test | 75 | 12.32 | 4.71 |
| Immediate Posttest | 75 | 11.53 | 3.43 |
| Delayed Posttest | 75 | 12.86 | 3.96 |
| **Grade 6** | | | |
| Attribution Test | 50 | 10.36 | 4.02 |
| Collection Test | 50 | 7.96 | 3.68 |
| Comparison Test | 50 | 13.40 | 3.79 |
| Immediate Posttest | 50 | 11.40 | 3.31 |
| Delayed Posttest | 50 | 12.42 | 3.38 |

Table 4.4

Reading Ability Mean Scores and Standard Deviations for All Reading Tests

| Test | N | Mean | Standard Deviation |
|---|---|---|---|
| **High Ability Readers (1)** | | | |
| Attribution Test | 48 | 13.64 | 4.19 |
| Collection Test | 48 | 10.83 | 4.35 |
| Comparison Test | 48 | 14.54 | 3.74 |
| Immediate Posttest | 48 | 12.81 | 3.10 |
| Delayed Posttest | 48 | 13.60 | 3.54 |
| **High Average Readers (2)** | | | |
| Attribution Test | 61 | 11.72 | 4.21 |
| Collection Test | 61 | 9.31 | 4.62 |
| Comparison Test | 61 | 12.09 | 4.80 |
| Immediate Posttest | 61 | 11.67 | 3.14 |
| Delayed Posttest | 61 | 12.72 | 3.86 |
| **Low Average Readers (3)** | | | |
| Attribution Test | 41 | 10.58 | 3.41 |
| Collection Test | 41 | 8.34 | 3.85 |
| Comparison Test | 41 | 10.53 | 4.51 |
| Immediate Posttest | 41 | 10.95 | 3.30 |
| Delayed Posttest | 41 | 11.09 | 3.97 |

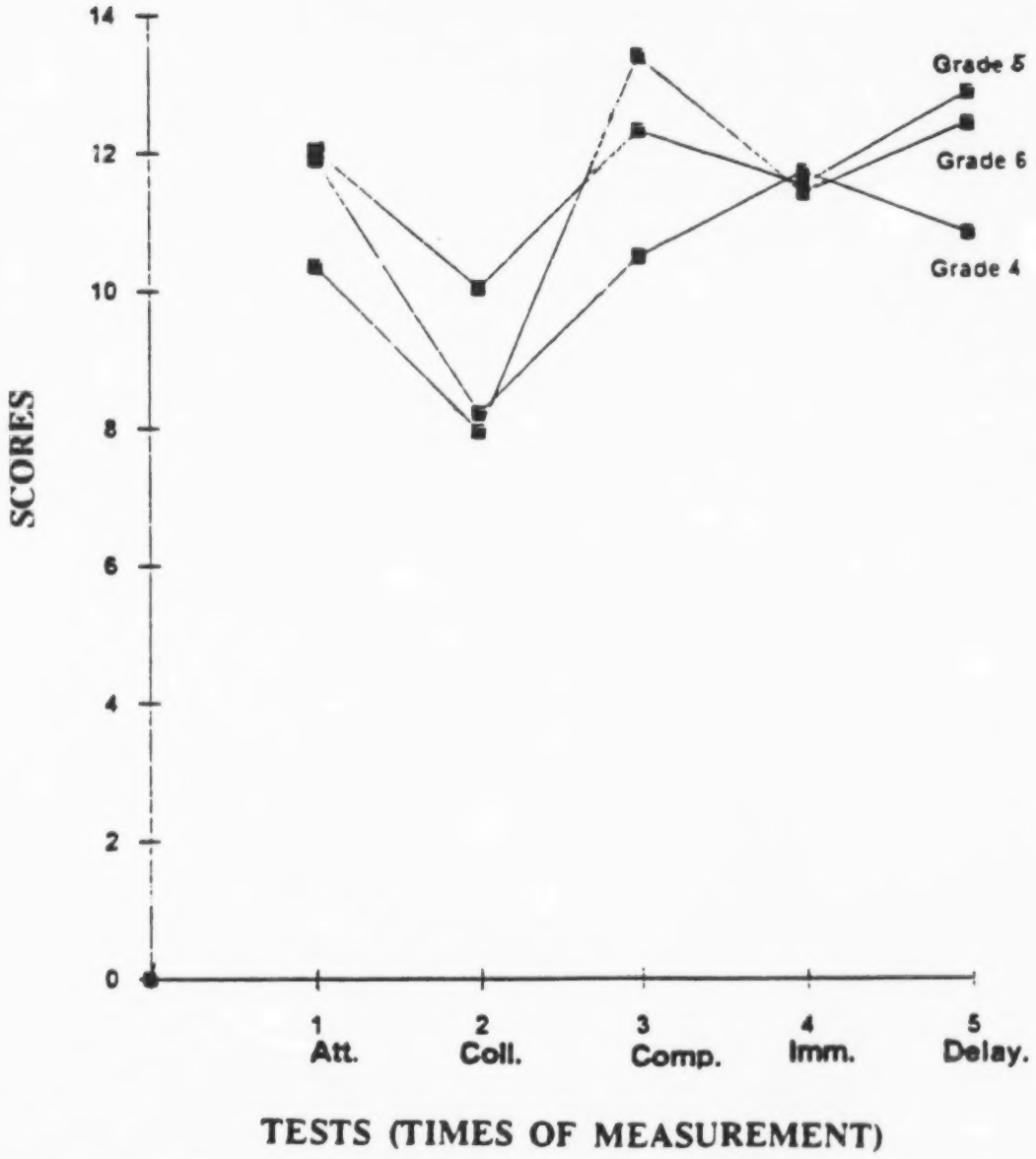
Table 4.4 continued

| | | | |
|---|---|---|---|
| **Low Ability Readers (4)** | | | |
| Attribution Test | 23 | 8.21 | 3.99 |
| Collection Test | 23 | 5.04 | 3.54 |
| Comparison Test | 23 | 10.00 | 2.95 |
| Immediate Posttest | 23 | 9.65 | 2.83 |
| Delayed Posttest | 23 | 9.65 | 3.25 |

A nonorthogonal repeated measures analysis of variance model was specified for the analyses, a model with three between-subjects effects--treatment, reading ability, and grade level-- and one within subjects effect--time of measurement, which specifically referred to the tests given after instruction in each of the three text structures. The analyses were performed two ways: using all five levels of time (attribution test, collection test, comparison test, immediate posttest, and delayed posttest) and using three levels of time (attribution test, collection test, and comparison test) in order to more accurately assess treatment effects. That is, the first three tests were the immediate posttests on the content contained in the three text structures and were intended to note differences between the text structures as well as differences among the strategies within the text structures, while the immediate and delayed posttests were analyzed to assess any overall differences among the three strategies (i.e., mental modeling, graphic organizer, and read/answer). (The test of prior knowledge was not included in the analyses because it was a measure of what students knew about the topic before the study began).

The two within-subjects and between-subjects tests (for both the five levels and the three levels of time) indicated main effects for reading ability (alpha = 0.0001) and for time (alpha = 0.0001). In addition, both analyses indicate a time x grade level interaction (alpha = 0.0001). This interaction is graphically displayed in Figure 2. The three levels of time analysis (tests for the effect of text structure instruction) indicated a main effect for treatment (alpha = .05), but the five levels of time analysis (tests for the effects of strategy instruction) did not. The results of the within-subjects and between-subjects effects are shown for both analyses in Table 4.5 and 4.6.

## Figure 2. Time (Tests) by grade level interaction, reading comprehension




Note. Att.=Attribution; Coll.=Collection; Comp.=Comparison; Imm.=Immediate; Delay.=Delayed

Table 4.5

Results of Nonorthogonal Repeated Measures Analysis of Variance for Reading Comprehension Tests with Five Times of Measurement

**Reading Scores for Between Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Treatment | 2, 137 | 197.70 | 98.85 | 2.32 | 0.10 |
| Reading Ability | 3, 137 | 1323.90 | 441.30 | 10.34 | 0.0001** |
| Grade Level | 2, 137 | 22.84 | 11.42 | 0.27 | 0.7655 |
| Treatment x Reading Ability | 6, 137 | 157.99 | 26.33 | 0.62 | 0.7163 |
| Treatment x Grade Level | 4, 137 | 142.36 | 35.59 | 0.83 | 0.5057 |
| Reading Ability x Grade Level | 6, 137 | 288.81 | 48.13 | 1.13 | 0.34 |
| Treatment x Reading Ability x Grade Level | 12, 137 | 423.41 | 35.28 | 0.83 | 0.622 |
| Error | | 5845.31 | 42.66 | | |

**Reading Scores for Within Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Time | 4, 548 | 1078.22 | 269.55 | 35.50 | 0.0001** |
| Time x Treatment | 8, 548 | 56.33 | 7.04 | 0.93 | 0.49 |
| Time x Reading Ability | 12, 548 | 109.71 | 9.14 | 1.21 | 0.27 |
| Time x Grade Level | 8, 548 | 322.08 | 40.26 | 5.32 | 0.001** |
| Time x Treatment x Reading Ability | 24, 548 | 243.00 | 10.12 | 1.34 | 0.13 |
| Time x Treatment x Grade Level | 16, 548 | 136.04 | 8.5 | 1.12 | 0.32 |
| Time x Reading Ability x Grade Level | 24, 548 | 166.64 | 6.94 | 0.92 | 0.57 |
| Time x Treatment x Reading Ability x Grade Level | 48, 548 | 411.05 | 8.56 | 1.13 | 0.25 |
| Error | | 4148.93 | 7.57 | | |

** $p < .001$

Table 4.6

Results of Nonorthogonal Repeated Measures Analysis of Variance for Reading Comprehension Tests with Three Times of Measurement

**Reading Scores for Between Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Treatment | 2, 137 | 183.08 | 91.54 | 3.16 | 0.04* |
| Reading Ability | 3, 137 | 958.89 | 319.63 | 11.04 | 0.0001** |
| Grade Level | 2, 137 | 12.90 | 6.45 | 0.22 | 0.80 |
| Treatment x Reading Ability | 6, 137 | 164.97 | 27.49 | 0.95 | 0.46 |
| Treatment x Grade Level | 4, 137 | 112.75 | 28.18 | 0.97 | 0.42 |
| Reading Ability x Grade Level | 6, 137 | 245.13 | 40.85 | 1.41 | 0.21 |
| Treatment x Reading Ability x Grade Level | 12, 137 | 408.01 | 34.00 | 1.17 | 0.30 |
| Error | | 3965.57 | 28.94 | | |

**Reading Scores for Within Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Time | 2, 274 | 916.33 | 458.16 | 46.75 | 0.0001** |
| Time x Treatment | 4, 274 | 29.52 | 7.38 | 0.75 | 0.55 |
| Time x Reading Ability | 6, 274 | 64.98 | 10.83 | 1.11 | 0.35 |
| Time x Grade Level | 4, 274 | 250.50 | 62.62 | 6.39 | 0.001** |
| Time x Treatment x Reading Ability | 12, 274 | 161.93 | 13.49 | 1.38 | 0.17 |
| Time x Treatment x Grade Level | 8, 274 | 82.20 | 10.27 | 1.05 | 0.39 |
| Time x Reading Ability x Grade Level | 12, 274 | 75.27 | 6.27 | 0.64 | 0.80 |
| Time x Treatment x Reading Ability x Grade Level | 24, 274 | 218.50 | 9.10 | 0.93 | 0.56 |

Since there were significant main effects for treatment, time of measurement (tests after text structure instruction), and reading ability, and significant interaction effects for time x grade, follow up univariate tests were conducted.

Main Effects For Treatment

Scheffe post hoc procedures were implemented (alpha = 0.05) to determine specific differences in mean scores.

Attribution test.

Results of Scheffe tests indicated both the mental modeling group (means = 12.31) and the graphic organizer group (means = 12.24) significantly outscored the read/answer group (means = 10.08). There were no significant differences between the mental modeling treatment and the graphic organizer treatment.

Collection test.

The graphic organizer condition (means = 10.09) significantly outscored the read/answer condition (means = 7.96). There were no significant differences between the mental modeling condition and the read/answer condition nor between the mental modeling group and the graphic organizer group.

Comparison test.

Once again, the graphic organizer condition ( means = 13.09) had significantly higher scores than the read/answer condition (means = 11.13) while the differences among the other groups were not significant.

Immediate and Delayed Posttests.

Scheffe tests were not conducted for treatment on the immediate and delayed posttests (tests for the effects of instructional strategies) because the five level analysis indicated no significant differences among the scores of the three groups on either test.

Main Effects For Reading Ability

Scheffe post hoc procedures were implemented (alpha = 0.05) to determine the significance of differences.

Attribution test.

Follow up tests demonstrated that high ability readers (means = 13.64) significantly outscored the high average readers (means = 11.72), low average readers (means = 10.58), and low ability readers

(means = 8.21) as well. In addition, the high average group significantly outperformed low ability readers. There were no notable differences between high average readers and low average readers, nor between low average readers and low ability readers.

Collection test.

Here, the high ability group (means = 10.83) significantly outscored both the low average (means = 8.34) and low ability groups (means = 5.04). The high average group (means = 9.31) and low average group outperformed the low group. There were no differences between the high ability group and the high average group.

Comparison test.

The high ability readers (means = 14.54) significantly outperformed the other three groups (means = 12.09, 10.53, 10.00), but there were no significant differences among any of the other readers.

Immediate Posttest

The high ability readers (means = 12.81) significantly outscored the low ability readers (means = 9.65), but there were no significant differences among the other groups.

Delayed Posttest.

Once again, the high ability readers' scores (means = 13.60) were significantly higher than both the low average (means = 11.09) and the low ability readers' scores (means = 9.65). The high average readers' scores (means = 12.72) were significantly better than the low ability readers. There were no significant differences between the high ability readers and the high average readers, nor between the high average group and the low average group.

Main Effects For Time (Tests After Instruction in Text Structure)

Scheffe tests (alpha = .05) indicated a significant difference between Test 1 (attribution test; mean = 11.52) and Test 2 (collection test; mean = 8.93) and between Test 3 (comparison test; mean = 12.12) and Test 2 (collection). In other words, the scores on the attribution test were significantly higher than those on the collection test and the scores on the comparison test were also significantly higher than the scores on the collection test. There were no significant differences between the scores on the attribution test and the scores on the comparison test.

Time x Grade Level Interaction

Tukey post hoc procedures (alpha = 0.05) were conducted to determine time by grade level differences.

Attribution test.

The Tukey results indicated that fifth graders (means = 12.04) significantly outscored sixth graders (means = 10.36) after exposure to the attribution text structure. There were no significant differences between fourth graders and fifth graders nor between fourth graders and sixth graders.

Collection test.

Again, the fifth graders (means = 10.04) significantly outscored the sixth graders (means = 7.96) after instruction in the collection text format. There were no significant differences between the fourth graders and the fifth graders nor between fourth graders and sixth graders.

Comparison test.

Here, the sixth graders (means = 13.40) significantly outperformed the fourth graders (means =10.50); the fifth grade (means = 12.32) also outperformed the fourth graders after instruction in the comparison text structure. There were no significant differences between the fifth graders and the sixth graders on the comparison test.

Immediate test of effect of instructional condition (mental modeling, graphic organizer, and read/answer).

There were no significant differences among any of the three grade levels on the immediate posttest.

Delayed test of effect of instructional condition (mental modeling, graphic organizer, and read/answer).

The fifth graders (means = 12.86) significantly outscored the fourth grade (means = 10.83) on the delayed posttest administered approximately ten days after the immediate posttest. There were no significant differences between the fourth grade and the sixth grade nor between the fifth grade and the sixth grade on this measure.

Writing Performance

The data were analyzed with a nonorthogonal repeated measures analysis of covariance (ANCOVA) using SAS, (1990), a procedure that removed the error of estimate from the dependent variable, and thus offered a more powerful test of the difference between the means of the treatment groups. This was performed in order to facilitate assessment of treatment effects on the writing samples. This was a 3 (treatment) X 3 (text structures) X 6 (times of measurement) design for the second dependent variable--writing performance.

The design for the writing performance component differed from the design for the reading comprehension component in its purpose. The reading portion of the experiment assessed treatment, reading ability, and grade level effects after specific text structure instruction. The writing portion, however, assessed only incidental treatment effects transferred to student writing after specific instruction in text structure. There was no instruction in writing. Consequently, reading ability and grade level were eliminated as grouping variables. It should be remembered that these were the same subjects whose reading comprehension was measured five times over the duration of the experiment. Students were randomly stratified by reading ability and by grade level within each treatment group and equivalency among treatment groups was verified by a test of prior knowledge.

The three levels of treatment included in the analysis were: Treatment 1, mental modeling; Treatment 2, graphic organizer; and Treatment 3, read/answer. The three levels of text structure were as follows: (a) attribution structure; (b) collection structure; and (c) comparison structure.

The six levels of the within-subject factor, time of measurement, for writing performance were as follows: Time 1, initial writing sample; Time 2, designed to test the transfer effect of the attribution text structure; Time 3, designed to test the transfer effect of the collection text structure; Time 4, designed to test the transfer effect of the comparison text structure; Time 5, designed to test the transfer effect of strategy instruction in text structure immediately after the experiment; and Time 6, designed to test the transfer effect of strategy instruction in text structure approximately ten days after the experiment ended.

The covariate was the initial writing sample (i. e., Time 1) completed by all three treatment groups prior to the beginning of the study to assess equality of groups with respect to writing performance. The results of the analysis on the initial writing sample (which served as the covariate) indicated no significant

differences among treatment groups [F (2, 170) = 0.23, p>0.79].

Tables 4.7 and 4.8 provide the means and standard deviations for all times of writing measurement, overall, and by treatment.

Table 4.7

Overall Mean Scores and Standard Deviations for All Writing Samples

| Scores | N | Mean | Standard Deviation |
|---|---|---|---|
| Initial | 173 | 6.78 | 2.14 |
| Attribution | 173 | 7.48 | 2.16 |
| Collection | 173 | 5.81 | 2.10 |
| Comparison | 173 | 7.29 | 2.08 |
| Immediate | 173 | 7.19 | 2.22 |
| Delayed | 173 | 6.88 | 2.32 |

Table 4.8

Treatment Mean Scores and Standard Deviations for All Writing Samples

| Scores | N | Mean | Standard Deviation |
|---|---|---|---|
| **Treatment 1 (Mental Modeling)** | | | |
| Initial | 60 | 6.91 | 2.06 |
| Attribution | 60 | 7.91 | 2.06 |
| Collection | 60 | 6.13 | 2.03 |
| Comparison | 60 | 7.21 | 1.86 |
| Immediate | 60 | 7.93 | 1.93 |
| Delayed | 60 | 7.25 | 2.15 |
| **Treatment 2 (Graphic Organizer)** | | | |
| Initial | 53 | 6.79 | 2.32 |
| Attribution | 53 | 7.52 | 2.16 |
| Collection | 53 | 5.71 | 2.14 |
| Comparison | 53 | 7.67 | 1.91 |
| Immediate | 53 | 7.15 | 2.04 |
| Delayed | 53 | 7.67 | 2.97 |
| **Treatment 3 (Read/Answer)** | | | |
| Initial | 60 | 6.65 | 2.09 |
| Attribution | 60 | 7.01 | 2.19 |
| Collection | 60 | 5.58 | 2.14 |
| Comparison | 60 | 7.03 | 2.40 |
| Immediate | 60 | 6.48 | 2.42 |
| Delayed | 60 | 5.81 | 1.99 |

In order to test the effects of text structure within each instructional strategy, scores on the attribution, collection, and comparison writing samples (i.e., time 2, time 3, time 4) were compared. In

addition, treatment effects of the instructional strategies within each time ( i.e., text structure) were examined. A separate assessment was made using the initial writing sample as a covariate with treatment for the immediate and delayed writing samples. This analysis was performed to test the overall effects of strategy instruction (i.e., mental modeling, graphic organizer, and read/answer). Therefore, two analyses were performed in order to more accurately assess both treatment and text structure effects. The results of the first ANCOVA within-subjects and between-subjects effects using the covariate are shown in Table 4.9.

Table 4.9

Results of Nonorthogonal Repeated Measures Analysis of Covariance for Writing Performance with Three Times of Measurement–Attribution, Collection, Comparison.

**Writing Scores for Between Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Treatment | 2, 169 | 19.83 | 9.91 | 1.57 | 0.21 |
| Initial Writing Sample | 1, 169 | 379.38 | 279.38 | 60.20 | 0.0001** |
| Error | | 1065.06 | 6.30 | | |

**Writing Scores for Within Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Time | 2, 338 | 21.78 | 10.89 | 4.84 | 0.0085** |
| Time x Treatment | 4, 338 | 15.75 | 3.93 | 1.75 | 0.13 |
| Time x Initial Writing Sample | 2, 338 | 67.03 | 33.51 | 14.88 | 0.0001** |
| Error | | 761.22 | 2.25 | | |

** $p < .001$

The main effects for the covariate (initial writing sample) and interaction effects for time (writing scores) x covariate (initial writing sample) demonstrated that the initial writing sample was significantly related to how well the subjects performed on the writing measures. In other words, the use of the covariate reduced the error variance and thus increased the precision of estimates and the power of hypotheses tests (Glass &

Hopkins, 1984). In addition, interrater reliability provided assurance that the covariate was measured with an acceptable level of error.

Although there were no overall treatment effects, results of the ANCOVA tests, where each of the three times of measurement (i.e., text structures) served as the dependent variable, indicated significant differences among groups after instruction in the attribution text structure [F (2, 169) = 4.37, p<0.014], but not after the collection text structure instruction [F (2, 169) = 1.16, p>0.31] nor after the comparison text structure instruction [F (2. 169) = 1.63, p>0.19]. Follow up Scheffe tests (alpha = .05) demonstrated that the mental modeling group (means=7.91) significantly outscored the read/answer control group (means=7.01) on the writing sample obtained after the attribution instruction.

Main Effects For Time (Test For Effects Of Text Structure)

Scheffe tests (alpha = .05) indicated a significant difference between Time 2 (attribution writing sample; mean = 7.48) and Time 3 (collection writing sample; mean = 5.81) and between Time 4 (comparison writing sample; mean =7.29) and Time 3 (collection). In other words, the scores on the attribution writing sample, and the comparison writing sample were significantly higher than the scores on the collection writing sample. There were no significant differences between the attribution and the comparison writing samples.

Main Effects For Strategy Instruction

Another ANCOVA was performed on the data using the initial writing sample as the covariate once again. This test examined the immediate and delayed writing samples designed to test the effects of the instructional strategies. Table 4.10 reports the results.

Table 4.10

Results of Nonorthogonal Repeated Measures Analysis of Covariance for Writing Performance with Two Times of Measurement–Immediate and Delayed.

**Writing Scores for Between Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Treatment | 2, 169 | 127.64 | 63.82 | 7.61 | 0.0007** |
| Initial Writing Sample | 1, 169 | 267.37 | 267.37 | 31.88 | 0.0001** |
| Error | | 1417.15 | 8.38 | | |

Table 4.10 continued

**Writing Scores for Within Subjects Effects**

| Source of Variation | df | Sum of Squares | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Time | 1, 169 | 0.000 | 0.000 | 0.00 | 0.9943 |
| Time x Treatment | 2, 169 | 26.63 | 13.31 | 2.51 | 0.08 |
| Time x Initial Writing Sample | 1, 169 | 0.672 | 0.672 | 0.13 | 0.7223 |
| Error | | 896.09 | 5.3023 | | |

** $p < .001$

These results demonstrated that with treatment, the covariate (initial writing sample) once again was significantly related to the writing performance of the students within each treatment group. However, there was no significant main effect for time (writing scores after the completion of all treatment to determine instructional strategy effects).

Main Effects For Treatment

Follow up Scheffe procedures (alpha = .05) indicated on the immediate writing sample, the mental modeling group (means = 7.93) significantly outscored the read/answer group (means = 6.48). The differences between the mental modeling group and the graphic organizer group, and between the graphic organizer group and the read/answer group were not significant.

The Scheffe test performed on the delayed writing sample means found the mental modeling group (means = 7.25) again outscored the read/answer group (means = 5.81) and the graphic organizer group (means = 7.67) also outscored the read/answer group. There was no significant difference between the means of the two experimental groups.

Student Interviews

Twenty one students were interviewed by the researcher. Three from each classroom (one from each group) were randomly selected to respond to an orally administered questionnaire of 21 questions. Student responses were recorded, tabulated, and categorized both by the reasearcher and by an independent reader, in order to increase the reliability and objectivety of the results as well as to minimize researcher inference. The summaries were consolidated by both raters and discrepancies and miscountings were

settled through discussion and retabulation. There was high agreement between the two readers. Below is a list of summarized conclusions generated by the student interviews:

1) Most students were unable to name the specific text structures, but all participants in the mental modeling and graphic organizer groups could describe their characteristics.

2) All but two students interviewed felt that their instructional page (i.e. mental modeling of the essay, graphic organizer, or questions) helped them to remember information.

3) Most students thought the picture was an aid in recalling content.

4) Students in the mental modeling group reported having an easier time writing the essays than those in the other two groups.

5) Students in all groups reported the short answer section of the tests to be difficult due to lack of study time and large amounts of information to remember.

6) The three instructional strategies used in this study generally are not utilized by elementary teachers when conducting lessons in social studies and science.

7) Overall, students perceived more improvement in their reading skills than in their writing skills.

8) Although the majority of students in the mental modeling group made a conscious effort to model their writing after a particular text structure, overall most students reported no attempt to imitate text structure in their essay writing.

9) Students in all groups increased their content knowledge of oceanography and mysteries of the sea.

10) Students in both the mental modeling and the graphic organizer groups believe their instructional strategy would be helpful in the classroom for learning content information.

11) More students in the mental modeling and graphic organizer groups than in the read/answer group believe they would recognize the text structures taught in this study in their textbooks.

12) Students in the graphic organizer group were able to recall more mysteries of the sea than students in each of the other two groups.

13) Most students in the mental modeling and graphic organizer groups would use that strategy in teaching students similar content.

14) Most students thought the comparison structure to be the most difficult and the attribution format to be the easiest.

15) Overall, students in all groups believed that oral reading and discussions enhance their comprehension of expository information.

16) Students in the mental modeling and graphic organizer groups exhibited a more positive attitude towards the study than students in the read/answer group.

## Conclusions, Discussion, and Implications

### Conclusions

The purpose of this study was threefold: 1) to determine whether a specific instructional condition in three text structure formats enhances upper elementary students' comprehension of expository text; 2) to ascertain whether these same instructional conditions and text structure formats significantly transfer to student writing performance; and, 3) to obtain information from students regarding their perceptions about the various instructional conditions and text structures.

The following conclusions may be drawn from the results of this experiment:

1. The use of graphic organizers as a pre-reading strategy to teach text structure improved the reading comprehension of upper elementary students.

2. The use of mental modeling as a pre-reading strategy to teach text structure to upper elementary students seems promising and is worthy of further research.

3. When comparing upper elementary students' reading comprehension results, fifth graders made the greatest gains on the reading comprehension tests after receiving instruction in text structure formats.

4. The use of mental modeling as a pre-reading strategy for teaching text structure to upper elementary students sometimes transferred incidentally to student writing performance.

5. The use of graphic organizers as a pre-reading strategy for teaching text structure to upper elementary students demonstrated promise for incidental transfer to student writing performance and should be investigated more fully.

6. Regardless of the treatment, high ability readers scored better on reading comprehension measures after instruction in text structure than did low ability readers.

7. After specific directed instruction in three text structures, the attribution and the comparison patterns enhanced both reading comprehension and writing performance more than the collection pattern. In other words, the attribution and the comparison structures were more "user friendly" to upper elementary

students after instruction.

8. Students in the two experimental conditions exhibited a stronger sense of text structure and a more positive attitude about their participation than did students in the control group.

## Discussion

### Reading Comprehension

According to Berkowitz (1986) and Armbruster, Anderson, and Ostertag (1987), the macrostructure (the higher order structure which represents the gist of the text) serves as the impetus behind students' recall and retention of content information. That is, the macrostructure, not the original text, provides the readers' clues for success in the completion of post-reading comprehension tasks. Text structure instruction teaches students about the macrostructure of informational text. This study demonstrated that students who were taught strategies for extracting information from text via its text structure significantly outscored students who were provided only with content questions ahead of time. These results verify the findings of many others who have concluded that training in text structure translates into higher levels of reading comprehension (e.g, Armbruster, Anderson, & Ostertag, 1987; Loman & Mayer, 1983; Englert & Hiebert, 1984; Meyer, 1975; Brooks & Dansereau 1983; Miller and George 1992). Indeed, both the mental modeling and graphic organizer strategies explicitly demonstrated specific text structure characteristics. The read/answer strategy served as an adequate content preview (Graves, Penn, & Cooke, 1985) but did not focus on the macrostructure of the essay and thus, students in the control group had a more difficult time remembering the content information. Providing students with questions ahead of time may be useful before narrative selections which have a familiar macrostructure (Herber & Nelson, 1975). However, when reading expository text, the questions do not provide enough of a sense of higher order structure.

The strategy that emerged overall as most effective in reading comprehension was that of graphic organizer. Students in this group consistently outscored the read/answer control condition after the attribution, collection, and comparison tests. In addition, this group outperformed the control group on the immediate posttest as well, although not to a significant degree. These results concur with the findings of Gillespie (1993), Armbruster, Anderson and Ostertag (1987), Armbruster, Anderson, and Meyer (1991), McGee and Richgels (1985), Alvermann (1981), and Dansereau et. al. (1979) among others. These results

indicate a high percentage of visual learners in today's classrooms. Young students have grown up with a steady "diet" of video games, television, movies, and computers so this finding is not surprising. The results, however, are in opposition to Berkowitz (1986) who found students who constructed their own graphic organizer outscored students who studied one constructed by the researcher. Students in this study were not given the construction option, but performed well with one provided for them.

Students in the mental modeling condition significantly outscored the read/answer group on the comprehension measure administered after the attribution instruction. Although they consistently outperformed the control condition at every other time of measurement, there were no other significant differences. This finding should be viewed positively. Duffy, Roehler, & Herrmann (1988) cautioned that poor readers often do not discover the cognitive processes crucial for successful reading experiences. Therefore, anything teachers can do to provide a vital link to these missing cognitive processes will help increase students' comprehension skills. It is likely that since this strategy relies heavily on auditory processing, and most younger students seem to be visual learners, it may require more time (Davey, 1993) and practice by the students to be effective than does the graphic organizer condition. Perhaps, too, this strategy is best reserved for use with older students who are better able to listen and abstract information. However, it seems the sooner this strategy is introduced to students, the sooner they will learn to take advantage of the benefits of this process. This is a promising technique that warrants further research.

Writing Performance

There are a variety of ways to teach students how to write in an expository format. Knudson (1988) found the most effective strategy for informational writing to be the presentation of model pieces of writing. Flood and Lapp (1987) contend that students are seldom exposed to expository/informational writing in basal readers and therefore have a difficult time both reading and writing expository text as they reach fourth grade and above. Therefore, they posit students should be taught expository reading and writing concurrently. Elkins (1968) found intensive reading, intensive writing, and the combination of reading and writing to be about equal as strategies for producing good writers. In this study, writing was viewed as incidental to the text structure and reading comprehension results because there was no actual instruction in writing. There is some evidence, however, that instruction in text structure to enhance reading skills will also result in improved writing, possibly because the expository essay serves as a model

(e.g., McGee & Richgels, 1985; Miller & George, 1992; Taylor, 1982; Taylor & Beach, 1984; Armbruster, Anderson & Ostertag, 1987; Pearson, 1985).

The results indicated that overall the mental modeling strategy positively impacted student writing. Students in this condition significantly outperformed the control condition at the attribution, immediate, and delayed writing samples. Mental modeling illuminates the macrostruture of expository text in a very explicit verbal manner. According to the interviewed students in this treatment, when they began to write they remembered more information and thus, produced better products.

It is interesting to note that at the time of the delayed writing sample, the mental modeling strategy as well as the graphic organizer treatment produced significant results. It is difficult to explain why the graphic organizer condition produced significance at the final time of measurement when it had not done so earlier in the study. The mental modeling condition had a more immediate impact on writing while the graphic organizer condition required more time to positively affect student writing performance. Students in the mental modeling group were exposed to identical modeling formats across all three text structures, while the graphic organizer group studied three very diverse visual patterns over the course of the treatment. It may be that the consistent format of the mental modeling examples enhanced student writing more quickly than did the more varied graphic organizers. More research is needed to discover the source of this perplexity.

Text Structure

Both the attribution and the comparison text structures emerged as the most salient in this study. Both structures positively affected student reading comprehension and writing performance. This finding contradicts Englert and Hiebert (1984) who found collection and enumeration formats to be most prominent with third and sixth graders. Indeed, their findings demonstrated that description (i.e., attribution) and comparison structures were most difficult for elementary subjects. This discrepancy was most likely due to a difference in grade levels as well as the design used to determine the friendliest text. Englert and Hiebert used a 12-item text structure measure consisting of three items each for four different organizational patterns--description, enumeration, sequence, and comparison. Subjects were given topical information about each format and were asked to rate how well target and distractor statements belonged with the original stimulus sentences. Students in this study, however, were instructed in specific text characteristics

and then tested in reading and writing skills. It is possible children in this study found the collection structure more difficult because of the order of presentation. The introduction of this format came after attribution and before comparison. In other words, it was the middle treatment and students may have been less motivated and interested than they were at either the beginning or the end. One puzzle, however, was why the fourth graders significantly outscored the sixth graders on the collection writing sample. It could be the fourth graders were more interested in the prompts, or perhaps their motivation was simply higher than the older students at this point in the study. Again, follow up research shifting the collection structure to either the first or last position may provide some enlightening answers.

Student Responses

Overall, the individual student interview responses verified the quantitative results. Students in the experimental groups demonstrated more knowledge about the content and text structure characteristics than did students in the control group. In addition, students in the experimental group exhibited a more positive attitude toward the study, perhaps because they had experienced more success and fewer frustrations with the assessment measures than did the control students. Although many students named the comparison structure as being the most difficult, in fact, they did well with it. It is likely that they were beginning to internalize the structure and perceived it as difficult, but were comprehending more than they consciously realized. In other words, they were developing schemata for the macrostructure and were struggling a bit, but were unconsciously assimiliating the structure and content information.

## Implications

In addition to the suggestions for further research cited above, the findings from this study need to be heeded at three levels: teacher education programs, school districts, and in classrooms.

First of all, teacher education programs need to emphasize that all teachers are teachers of reading and to prepare students accordingly through specific classes and varied student teaching experiences.

Teachers of third grade and above need instruction in text structure, its role in the reading and writing process, as well as instruction and implementation practice in macrostructure strategies at different grade levels.

Next, it is school districts' responsibility to provide mandatory inservices and classes on text structure to inservice teachers, who usually possess a myriad of textbook materials, but are rarely given

instruction in how best to communicate the content to students. Teachers need to be current with the research literature that affects their student poulations and districts can facilitate the dissemination of the research literature through methods like partnerships with universities and research mentors.

Third, teachers can no longer assume that if an upper elementary student has "learned to read" that he/she automatically can "read to learn." Classroom teachers need to help students overcome lack of prior knowledge, difficult vocabulary, and conceptual density of texts through strategic instruction and pre-reading activities that will allow students to comprehend informational material. Techniques such as mental modeling and graphic organizers have demonstrated their effectiveness in improving students' reading and writing skills. Teachers need to take advantage of professional growth opportunities to increase their knowledge and expertise of text structure and other content area instructional strategies.

Finally, university researchers need to continue to pursue text structure research. We know that instruction in text structure translates to improved reading and writing skills (Armbruster, Anderson, & Ostertag, 1987) but there is still much to discover. This study has contributed to the growing body of research in content-area reading skills. We have learned that graphic organizers are effective with students as young as fourth grade, that mental modeling has more impact on student writing than on student reading, and that providing questions to pupils as a pre-reading strategy is not an effective technique for highlighting the macrostructure of an essay or chapter. Researchers, school districts, and classroom teachers need to continue to explore, individually and collectively, the effectiveness of specific text structure strategies, the facilitation of discourse patterns, and the manipulation of content by students within the target strategies and discourse structures. The outcomes of this exploration will provide effective curricular and instructional support for students as they struggle to become independent learners.

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## MENTAL MODELING ATTRIBUTION EXAMPLE

### FLYING FISH

If Mrs. Troyer was given the task of reading and remembering as much as she could about the flying fish, here are some tips on how she would go about understanding the information:

First of all, I would carefully examine the picture. I would notice that the flying fish appears to have transparent wings and looks about average size.

Next, I would think about the three headings--unique features, habitat and diet, and appearance. These headings tell me the exact information I will be reading about.

Third, I would begin to carefully and slowly read the passage. I would remember to reread any sentence that did not make sense to me the first time.

Fourth, I would read the whole passage a second time and ask myself questions about what I was reading to check my understanding because I know I will remember more information the more I read it, and the more I quiz myself.

Finally, after both readings, I will take each heading and try to remember and summarize some important details relating to the heading. For example, the flying fishes' unique features are that it has the ability to soar through the air at heights of three to fifteen feet because of the rapid beating of its tail beneath the water, and that it is unable to alter its direction in the air. What I remember about its habitat and diet is that it is a very social creature, lives near the water's surface, eats small fish and crustaceans. When it does "fly" it always risks being a meal itself because it can be chased by frigate birds, albatrosses, and gulls. I also remember that it is a blue fish with silver sides and belly. I try to picture the flying fish in my mind. I like blue and silver so I know that I will always be able to picture this fish's appearance.

COMPARISON


"Noisemaker of the sea"
160 species
Brownish-gr y w/ scaly he ds
Swim bladde makes sound
Does not wash ashore
CROAKER
Salt-water animals
Unusual abilities
Carnivorous
Found in al oceans
COMB JELLY
Flashes of blue & gree
Invisible in water
80 species
Called "cat's eyes
Catches foo with tentac

## AN EXAMPLE OF THE READ AND ANSWER GROUP'S TASK (COLLECTION)

Silently read the following essay on the Portugese Man-Of-War two times and then answer the following questions in complete sentences. Try to answer without looking back to the essay.

1. Describe the appearance of the float.

2. How long are the tentacles?

3. Explain how the tentacles capture food.

4. What are some of the various functions of the polyps?

5. Why is it important for the polyps to work together?